METRO DE PANAMA S.A.

ENERGY EFFICIENCY FOR PANAMA CITY METRO L2

CASE STUDY

Alstom* celebrated, in April 2019, the commercial service of Panama Metro Line 2.
Thanks to an integrated and energy efficient system, the city of Panama becomes a leader in sustainable mobility with the first metro network using 100% Hesop reversible substations.

KEY BENEFITS

Hesop reversible substation allows **full recovery** (99%) of available braking energy.

Hesop allowed to **reduce the number of substations** on the line from 8 down to 7: an **investment reduced by 12.5%**.

Hesop "2 in 1" **rectifier and inverter** modes in the same unit allows fine tuning of voltage settings **to maximise regenerative braking** and **increased energy recovered by 18.8%**.

Other characteristics were also improved beyond substation number reduction:
- Voltage drops reduced along the line
- Track to earth voltage improved

Overall line 2 **energy saving of 16%** compared to conventional technology.

COUNTRY

Panama

CONTEXT

Following opening of Panama Metro Line 1 in April 2014, the *Secretaria del Metro de Panama* renewed its confidence to *Consorcio linea 2* and the Alstom-lead *Grupo de Empresas* consortium, for the design and build of an integrated system for Line 2: a line of 21 km, 16 stations and operated by 21 5-car Metropolis trains.

The line features Alstom's Urbalis Communication Based Train Control (CBTC) solution and Hesop reversible substations, making Panama Line 2 the first metro line in the world to feature 100% reversible traction substations.

SOLUTION

In order to meet the customers expectations for energy efficiency and remove energy waste, Alstom designed and built a system with Hesop 1500 V 4MW reversible substations.

Thanks to Hesop unique features, Alstom reduced the number of required substations from 8 down to 7 while improving the performance of the line:
- HESOP controlled output voltage / current characteristics to allow to compensate the voltage drop in the substations
- Locally around the section where the removed substation is, the line voltage is lower but remains largely above the design criterion
- Track to earth voltage is also improved.

To make the most of Hesop unique 2 in 1 functionality, Alstom also fine tuned on-board and track side equipment to maximise regenerative braking, thus increasing energy recovery by 18.8% and reducing further net consumed energy.
The overall line performance shows a reduction of net energy consumption of more than 16%, compared to the same line with conventional diode rectifier substations, after 6 months of revenue service.

*Alstom is leader of Grupo de Empresas (Alstom, TSO/CIM, Thales, Sofratesa), part of Consorcio Linea 2.

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TECHNICAL SCOPE AND KEY FEATURES

POWER

	Alstom (Installed)	**Conventional** (Comparison)
Voltage	1500 V	1500 V
Power	4 MW	4 MW
Number of substations (line)	7	8
Technology	Hesop Reversible	Diode rectifier
Voltage drop regulation	Improved	Normal
Track to earth voltage	Improved	Normal
Regenerative braking	Maximised	Limited
Available braking energy recovered	99%	0%
Voltage settings	Improved	Limited
Energy consumed (base 100)	84	100

SYSTEMS

Rolling stock	21-5 car METROPOLIS™ trains
Train control	URBALIS™ CBTC system guaranteeing safe, smooth and seamless rides
Interlocking	SMARTLOCK™ electronic interlocking

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